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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Total Number of Pages in This Submission	38

Application Number	09/864,339
Filing Date	May 25, 2001
First Named Inventor	Atkinson
Art Unit	3641
Examiner Name	Aileen Baker Felton
Attorney Docket Number	568

ENCLOSURES *(Check all that apply)*

- [x] Fee Transmittal Form
  - [ ] Fee Attached
  - Fee previously paid.
- [ ] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
  - [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) _____
  - [ ] Landscape Table on CD
- [ ] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [x] Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- [ ] Proprietary Information
- [ ] Status Letter
- [ ] Other Enclosure(s) (please Identify below):

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	DYNO NOBEL INC.		
Signature	Robert A. Bingham		
Printed name	Robert A. Bingham		
Date	February 11, 2005	Reg. No.	26,530

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature	Heidi B. Elder		
Typed or printed name	Heidi B. Elder	Date	February 11, 2005

PTO/SB/17 (12-04v2)
Approved for use through 07/31/2006. OMB 0651-0032
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Effective 12/08/2004.
Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2005

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 0.00

Complete if Known	
Application Number	09/864,339
Filing Date	May 25, 2001
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Examiner Name	Aileen Baker Felton
Art Unit	3641
Attorney Docket No.	568

METHOD OF PAYMENT (check all that apply)

☐ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____

☑ Deposit Account Deposit Account Number: 09-0945 Deposit Account Name: Dyno Nobel Inc.

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☐ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**

☑ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☐ Credit any overpayments

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FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

Application Type	FILING FEES Fee ($)	FILING FEES Small Entity Fee ($)	SEARCH FEES Fee ($)	SEARCH FEES Small Entity Fee ($)	EXAMINATION FEES Fee ($)	EXAMINATION FEES Small Entity Fee ($)	Fees Paid ($)
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 (including Reissues)	50	25
Each independent claim over 3 (including Reissues)	200	100
Multiple dependent claims	360	180

Total Claims _____ - 20 or HP = _____ x Fee ($) _____ = Fee Paid ($) _____

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims _____ - 3 or HP = _____ x Fee ($) _____ = Fee Paid ($) _____

HP = highest number of independent claims paid for, if greater than 3.

Multiple Dependent Claims Fee ($) _____ Fee Paid ($) _____

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets _____ - 100 = _____ Extra Sheets / 50 = _____ Number of each additional 50 or fraction thereof (round **up** to a whole number) x Fee ($) _____ = Fee Paid ($) _____

4. OTHER FEE(S)

Fees Paid ($)

Non-English Specification, $130 fee (no small entity discount) _____

Other (e.g., late filing surcharge): _____ _____

SUBMITTED BY

Signature	Robert A. Bingham	Registration No. (Attorney/Agent) 26,530	Telephone 801-328-6464
Name (Print/Type)	Robert A. Bingham		Date February 11, 2005

AF/3641

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of Atkinson et al.	)	
Serial No.: 09/864,339	)	Group Art Unit: 3641
Filed: May 25, 2001	)	Examiner: Aileen Baker Felton
For: Reduced Energy Blasting Agent and Method	)	

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

This is an amended Appeal Brief to support an appeal from the final rejection of the Examiner dated April 23, 2004, rejecting claims 10-11, 13-16 and 18, all of the claims in the case. The requisite fee of $340.00 previously has been paid.

TABLE OF CONTENTS

(i) Real Party in Interest

Applicants (also referred to herein as appellants) have assigned their rights to the invention and this application to their employer, Dyno Nobel Inc., and such assignment has been recorded by the Assignment Division of the U.S. Patent and Trademark Office.

(ii) Related Appeals and Interferences

There are no related appeals and interferences.

(iii) Status of Claims

Claims 10-11, 13-16 and 18 are the subject of this appeal and are set out in the Claims appendix. No other claims are pending. Claims 1-9, 12, 17 and 19-24 have been cancelled. (Claims 1-9 and 19-24 were cancelled in response to an election requirement.)

(iv) Status of Amendments

No amendment has been filed subsequent to final rejection. (The last amendment was filed in this case on October 21, 2003, and entered by the Examiner. The claims as set out in the Claims appendix include the entered amendments.)

(v) Summary of Claimed Subject Matter

Claim 10 is the sole independent claim and is directed to a method of reducing the energy of an emulsion blasting agent as it is being loaded into a borehole (specification, page 1, lines 1-8 of first paragraph). An energy-reducing agent is added to the emulsion blasting agent as the blasting agent is being conveyed for ultimate loading into the borehole (specification, page 1, lines 6-7 of first paragraph; page 6, lines 1-2; page 10, lines 7-11).

The energy-reducing agent is selected from the group consisting of water and aqueous solutions (specification, original claim 4; page 11, lines 3-4). The Examiner argues that because the preamble to claim 10 contains "comprising," the Markush expression in step c) of claim 10 can be construed broadly enough to include other components than "water and aqueous solutions." Appellants disagree and maintain that the "consisting of" language in step c) closes the group to just water and aqueous solutions.

The energy reducing agent is mixed uniformly and homogeneously into the emulsion blasting agent to form a second discontinuous phase in an amount of from about 5% to about 22.5% by weight of the emulsion blasting agent (specification, page 5, lines 7-16; page 10, lines 14-17; original claim 24; page 11, lines 5-6).

Gassing agents are added to the emulsion blasting agent to reduce its density and increase its sensitivity (specification, page 10, lines 17-21 and page 11, lines 1-2) and the conveyed emulsion blasting agent is loaded into a borehole (specification, page 6, lines 4-5).

Dependent claim 15 specifies that the borehole is a perimeter borehole (specification page 2, beginning with line 6 to page 4, line 8).

Dependent claim 16 allows for the energy reducing agent and gassing agent to be added in varying amounts to impart varying energies and densities to the emulsion blasting agent throughout the length of the borehole (specification, page 4, lines 9-18).

(vi) Grounds of Rejection to be Reviewed on Appeal

Whether claims 10-11, 13-16 and 18 are patentable under 35 USC 103 over Lawrence et al. (U.S. patent no. 4,526,633) in view of Engsbraten (U.S. patent no. 5,271,779), Waldock (U.S. patent no. 4,959,108) and Patterson et al. (U.S. patent no. 5,670,739), in further view of Guralnik (a dictionary reference) and Conrad (U.S. patent no. 3,692,547).

(vii) Argument

Claims 10-11, 13-14 and 18 Rejected under 35 USC 103. Independent claim 10 covers a method "of reducing the energy of an emulsion blasting agent as it is being loaded into a borehole" comprising the steps of selecting an emulsion blasting agent as specified, conveying the emulsion blasting agent, adding an energy-reducing agent (limited to water or aqueous solution) to the emulsion blasting agent as it is being conveyed, mixing the energy-reducing agent uniformly and homogeneously into the emulsion blasting agent in the claimed amount "to form a second discontinuous phase," adding gassing agents and loading the conveyed emulsion blasting agent into a borehole. By adding the energy-reducing agent as a second discontinuous phase, the gassed emulsion blasting agent is found to retain both its sensitivity and stability, which would not be the case if the significant amounts of water or aqueous solution as claimed in step d) were combined initially with the inorganic oxidizer salt solution or if the water or aqueous solution were added in a manner that did not form a second discontinuous phase, i.e., the water combines with the original discontinuous phase.

A water-in-oil emulsion is an intimate dispersion of discrete, fine droplets of water or aqueous solution (in this case an inorganic oxidizer salt solution) in a continuous oil phase that forms a thin film of oil around each droplet. An emulsifier is

present in minor amount as a surface active agent to help keep the phases separate and the droplets dispersed. A commonly known water-in-oil emulsion is mayonnaise. In an emulsion blasting agent, the weight ratio of the droplets to oil is roughly 94:6, and the volume ratio is roughly 90:10. A cross-section of an emulsion phase would look somewhat like a cross-section of a beehive, with the walls of the beehive honeycomb structure representing the continuous oil phase and the hexagonal cells representing the solution droplets.

This emulsified state is thermodynamically and inherently unstable, since the droplets want to coalesce and the dissolved salts in the droplets become supercooled (following formation of the emulsion at a temperature above the crystallization temperature of the inorganic oxidizer salt solution) and thus want to crystallize. Either of these events can cause a breakdown of the emulsion phase and consequent desensitization of the emulsion blasting agent to detonation. (This desensitization occurs because the oxidizer molecules from the inorganic oxidizer salt solution droplets and the fuel molecules from the organic liquid continuous oil phase are no longer as intimately in contact with each other and thus cannot react as readily to produce an explosive reaction.)

Maintaining a stable and thus sensitive emulsion phase is a ongoing struggle in the explosives industry, particularly when the

emulsion phase is subjected to shear stress during transfer or loading operations (such as when pumping the fluid emulsion blasting agent from one container to another or into a borehole) or when additional ingredients are added and mixed into the emulsion phase (such as energizing aluminum particles or sensitizing glass microballoons). These dynamic operations can cause or accelerate the breakdown of the emulsion phase.

Further, water is known to desensitize emulsion blasting agents since it is non-reactive (essentially inert), absorbs energy (especially when vaporized) and generally dilutes the reactive components.

The method of claim 10 provides way in which an energy-reducing agent (water or aqueous solution) can be added and dynamically mixed into the emulsion phase to reduce significantly the energy of the emulsion blasting agent without unduly destabilizing and desensitizing it. Simply adding from about 5% to about 22.5% by weight of additional water or aqueous solution to an emulsion blasting agent, without forming a second discontinuous phase, would be detrimental if not fatal to the performance of the explosive.

The limitations in independent claim 10 distinguish it from the prior art. The claim requires that the energy-reducing

agent, either water or an aqueous solution, be mixed uniformly and homogeneously into the emulsion blasting agent "to form a second discontinuous phase." This is not just "watering down" an explosive, as the Examiner alleges. Rather, it is an inventive way of adding water to an explosive to reduce its energy without desensitizing or destabilizing it. (The original or first discontinuous phase remains essentially intact and reactive with the surrounding fuel phase during the detonation.) This is not disclosed, suggested or implied in any of the references cited by the Examiner.

Lawrence et al., Engsbraten and Waldock all disclose adding "dry" ingredients to an emulsion phase. See Lawrence et al., col. 2, lines 55-59; Engsbraten, col. 2, lines 46-49; and Waldock, col. 3, lines 57-62. Although Lawrence et al. disclose that the proportion of ingredients being blended to form a slurry blasting agent (which has a continuous aqueous phase) can be varied as the composition is being delivered into the borehole (col. 1, lines 42-54), they disclose in col. 2 adding only dry ingredients to an emulsion blasting agent. Engsbraten discloses the use of porous, non-aqueous, bulk fillers (solids) as his energy-reducing agent. Once combined with an emulsion phase, the mixture becomes non-pumpable. Further, the emulsion phase in Engsbraten is used in an amount only sufficient for improving adherence between the particulate oxidizer salt and the particulate filler. Waldock

similarly uses an inert bulking agent to vary the energy in his composition. This inert, solid bulking agent behaves as an energy diluent, decreasing the "shock" energy by absorbing heat and not providing additional work energy during detonation.

In contrast, claim 10 requires the addition of an energy-reducing agent in the form of water or aqueous solution. Step d) of claim 10 further requires that the liquid energy-reducing agent form a second discontinuous phase in the water-in-oil emulsion phase. The three cited references described above are fatally deficient in that they do not disclose the addition of a liquid, energy-reducing agent in the form of water or aqueous solution and in the claimed amount to an already formed emulsion blasting agent and that such energy-reducing agent be mixed uniformly and homogeneously into the emulsion blasting agent "to form a second discontinuous phase."

As explained in the specification on page 5, lines 7 et seq.:

> The present invention differs from this prior art in that the water or aqueous solution added to the emulsion blasting agent in the present invention is added to the emulsion blasting agent in an amount sufficient to reduce significantly its energy and is mixed uniformly and homogeneously throughout the emulsion phase. In

fact, when mixed in this manner the water or aqueous solution forms a second discontinuous droplet phase to that formed by the initial oxidizer salt solution component. This second discontinuous phase renders the emulsion blasting agent more sensitive and stable than if the water or aqueous solution were combined initially with the inorganic oxidizer salt solution or if they were not mixed uniformly and homogeneously throughout the emulsion phase. (Emphasis supplied.)

Appellants take no issue with the Examiner's citation of Guralnik (a dictionary definition) or Conrad, which discloses, as the Examiner indicates, controlling density by subsequent addition of ingredients. In fact, this concept is discussed in general in the background section of appellants' specification.

Patterson et al., brought to the attention of the Examiner by applicants in their amendment filed October 21, 2003, at first blush, appears to be closer art. Although Patterson et al. disclose an emulsion composition having a second discontinuous phase, the second discontinuous phase is added in the form of another emulsion phase, not water or aqueous solution as required in claim 10, and thus the resulting composition is a blend of two emulsions. Moreover, the second emulsion phase is added principally to increase stability of the composition, particularly

when AN prills are used. (See col. 4, lines 9-19.) Further, the second emulsion phase is not added as the emulsion blasting agent is being conveyed for loading into a borehole, as required in claim 10. The second emulsion phase in Patterson et al. is a cumbersome way to add water and requires that two separate emulsion phases first be formed and then handled separately. The Patterson et al. reference does not render the claimed invention obvious.

The Examiner simply is wrong in construing claim 10 so broadly that Patterson et al., in his opinion, invalidates it. The Examiner incorrectly construes the "comprising" term in the preamble of method claim 10 as opening the Markush expression in step c) of claim 10 to components other than those listed. Even though the preamble in method claim 10 contains "comprising" before the listing of the method steps, that does not mean that the Markush expression in step c) ("selected from the group consisting of water and aqueous solutions") somehow should be read to include a water-in-oil emulsion phase (as disclosed in Patterson et al.) as an unspecified third member of the group. The "consisting of" language in step c) refers to components, not method steps, and thus claim 10 is closed with respect to those components. See Berenter v. Quigg, 14 USPQ 2nd 1175 (DC Dist. Of Columbia 1988), also cited in Ex Parte Jerold C. Rosenfeld et al., 1997 WL 33135341, (Bd.Pat.App. & Interf. Jan. 1, 1997) (Appeal No. 1997-2572, Application 08/220,562). That is the proper and logical way

to read claim 10. Moreover, the specification supports this logical construction since the only energy reducing agents disclosed therein are water and aqueous solutions.

In his office actions, the Examiner goes to length to explain what he means by "watered down," and also that a strong emulsion (explosive) may be later "watered" as desired for diluted strength. Appellants do not take issue with these characterizations or that it would be expected that simply adding water would have this effect. But as stated above this is not what appellants are claiming.

Even though appellants' final composition contains a considerable amount of water, it remains stable and detonable over time because the additional water is added to the emulsion phase in the form of a second discontinuous phase. If that amount of water simply were added to or combined with the aqueous salt solution used to form the emulsion phase, the same detonability would not be achieved. Thus the order of the steps and manner of incorporation are important.

Appellants have found that by mixing this high amount of water or aqueous solution uniformly and homogeneously into the emulsion blasting agent to form a second discontinuous phase, the emulsion remains reliably detonable. For example, mix 4, described on page

12 of the specification, and in Tables 1 and 2 on page 13, sat for one hour before being detonated but remained reliably detonable even when its volume energy was reduced by about 55% and as much as 20% by weight water was added and mixed uniformly and homogeneously into the composition. The energy-reducing agent must be added to an already formed emulsion blasting agent in order for the energy-reducing agent to form a second discontinuous phase within the continuous phase of the emulsion blasting agent.

Another advantage of the invention is that the energy-reducing agent reduces significantly the shock to bubble energy ratio of the emulsion blasting agent. As explained on page 12 of the specification:

> The shock to bubble energy ratio changed from about 56/44 with standard emulsion blasting agent (mix 1) to about 40/60 for gassed emulsion blasting agent with 20% energy-reducing agent (mix 4). This shift in energy from shock to bubble is highly desirable in blasting operations where wall and perimeter control is required.

None of the references teach or disclose this beneficial effect of decreasing the shock to bubble energy ratio.

In the Examiner's last communication, his Advisory Action mailed August 20, 2004, he holds to his characterization of the invention: "This invention really is watering down the emulsion explosive." He is looking at a perceived end result and not the method claim language. Appellants have shown (and claimed) that how and when the water is added is key. The Examiner's comment about this invention possibly showing up on an internet page as a "funny patent" is disappointing and indicates to appellants a lack of understanding of the invention. In dismissing the declaration filed in the case, the Examiner in the same Advisory Action comments that the declarant appears to misunderstand the prior art and the "broad claim construction" employed by the Examiner. His further comment that "patent law concepts are less understood by those not versed in patent law" also is unhelpful because his asserted broad claim construction is shown above simply to be too broad in view of the "consisting of" language in step c) of claim 10 and relevant case law.

Claim 15 Rejected Under 35 USC 103.

Dependent claim 15 specifies that the borehole is a perimeter borehole, which as explained in the specification on pages 2-4, makes the invention particularly advantageous since perimeter boreholes can be loaded with a less energetic emulsion blasting agent, while the internal boreholes in the pattern can receive a more energetic load, both from the same base emulsion blasting

agent formulation. This versatility is highly desirable and is not disclosed in the cited references.

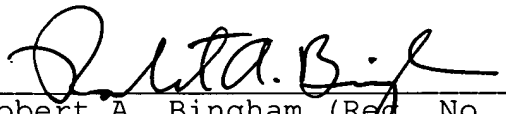
Claim 16 Rejected Under 35 USC 103.

Dependent claim 16 further allows for energy and density variation throughout the length of a given borehole, also advantageous as explained in the full paragraph on page 4 of the specification, which reads:

> Another advantage of the method of the present invention is that the energy of the emulsion blasting agent can be variably controlled along the axis of the borehole, as the blasting agent is loaded. This can be accomplished not only by varying the amount of energy reducing agent added as described above but also by adding varying amounts of gassing agents to the emulsion blasting agent to reduce variability its density. In combination, the density, sensitivity, and energy of the emulsion blasting agent can be tailored and varied from hole to hole and even within a hole. Such tailoring can compensate for rock variations along the length of the borehole, increasing pressure heads with borehole depth and other factors.

For the reasons set forth above, appellants respectfully contend that each claim is patentable, and therefore, reversal of the rejection is solicited.

Respectfully submitted,



Robert A. Bingham (Reg. No. 26,530)
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Date: February 11, 2005

(viii) Claims Appendix

10. A method of reducing the energy of an emulsion blasting agent as it is being loaded into a borehole comprising the steps of:

a) selecting an emulsion blasting agent comprising an aqueous inorganic oxidizer salt solution forming in droplet form a discontinuous phase and an organic liquid fuel forming a continuous phase;

b) conveying the emulsion blasting agent;

c) adding an energy-reducing agent to the emulsion blasting agent as it is being conveyed wherein the energy reducing agent is selected from the group consisting of water and aqueous solutions;

d) mixing the energy-reducing agent uniformly and homogeneously into the emulsion blasting agent to form a second discontinuous phase in an amount of from about 5% to about 22.5% by weight of the emulsion blasting agent;

e) adding gassing agents to the emulsion blasting agent to reduce its density and increase its sensitivity; and

f) loading the conveyed emulsion blasting agent into a borehole.

11. A method according to claim 10 wherein the energy-reducing agent is added in an amount of from about 7.5% to about 17.5% by weight of the emulsion blasting agent.

13. A method according to claim 10 wherein the aqueous solutions contain solutes selected from the group consisting of inorganic oxidizer salts, urea, glycols and inorganic acids.

14. A method according to claim 10 wherein the gassing agents are added in amounts sufficient to reduce the density of the emulsion blasting agent to a range of from about 0.60 g/cc to about 1.30 g/cc.

15. A method according to claim 10 wherein the borehole is a perimeter borehole.

16. A method according to claim 10 wherein the energy reducing agent and gassing agents are added in varying amounts as the borehole is loaded to impart varying energies and densities to the emulsion blasting agent throughout the length of the borehole.

18. A method according to claim 10 wherein the conveyed emulsion is pumped.

(ix) Evidence Appendix

Attached is a Rule 132 Declaration of Dr. Don H. Cranney, a Ph.D. in Analytical Physical Chemistry, who has engaged in explosives research for over 24 years. The Examiner entered this Declaration into the record in his Advisory Action mailed August 20, 2004, wherein he comments on the Declaration.

IN THE UNITED STATES PATENT AND

TRADEMARK OFFICE

In re Application of: Atkinson et al.	
Serial No.: 09/864,339	Examining Group No. 3641
Filed: May 25, 2001	Examiner: Edward A. Miller

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION UNDER RULE 132

Dear Sir:

I, Dr. Don H. Cranney, hereby declare as follows:

1. I am the Explosives Products Manager in Dyno Nobel Inc.'s Research, Technology and Engineering Department. Dyno Nobel Inc. is the assignee of the above-captioned U.S. patent application (the "application") and is a major manufacturer in the United States of

commercial explosives, including emulsion blasting agents of the type described in the specification of the application.

2. My education background includes a Bachelor of Science degree in Chemistry from Brigham Young University in 1969. In 1976, I received a doctorate degree in Analytical Physical Chemistry from Brigham Young University. In March 1980, I became employed in the explosives industry and from then to the present time have conducted and supervised the conducting of research and product development of emulsion explosives of the type described in the application and thus, during that time, have become familiar with the general level of knowledge of those having ordinary skill in this art.

3. I have reviewed the specification and present claims of the application, the previous office actions filed in this case and the responses by Applicants thereto, Applicants' Brief in Reply, the current office action mailed April 23, 2004, and the references cited by the Examiner.

4. The invention relates to a water-in-oil emulsion blasting agent (or in common terms an "explosive") that comprises an inorganic oxidizer salt solution as a discontinuous phase and an organic liquid fuel as a continuous phase of the emulsion (both

phases together commonly are referred to as the "emulsion phase"). More particularly, the invention relates to a method of variably reducing the energy of the emulsion blasting agent by the addition of an energy reducing agent (water or aqueous solution) in a way that does not destabilize the emulsion phase. Emulsion blasting agents or explosives typically are used for fracturing or displacing rock, ore or overburden in mining and construction applications.

5. A water-in-oil emulsion is an intimate dispersion of discrete, fine droplets of water or aqueous solution (in this case an inorganic oxidizer salt solution) in a continuous oil phase that forms a thin film of oil around each droplet. An emulsifier is present in minor amount as a surface active agent to help keep the phases separate and the droplets dispersed. A commonly known water-in-oil emulsion is margarine or butter. In an emulsion blasting agent, the weight ratio of the droplets to oil is roughly 94:6, and the volume ratio is roughly 90:10. A cross-section of an emulsion phase would look somewhat like a cross-section of a beehive, with the walls of the beehive honeycomb structure representing the continuous oil phase and the hexagonal cells representing the solution droplets.

6. This emulsified state is thermodynamically and inherently unstable, since the droplets want to coalesce and the dissolved salts in the droplets become supercooled (following formation of the emulsion at a temperature above the crystallization temperature of the inorganic oxidizer salt solution) and thus want to crystallize. Either of these events can cause a breakdown of the emulsion phase and consequent desensitization of the emulsion blasting agent to detonation. (This desensitization occurs because the oxidizer molecules from the inorganic oxidizer salt solution droplets and the fuel molecules from the organic liquid continuous oil phase are no longer as intimately in contact with each other and thus cannot react as readily to produce an explosive reaction.)

7. Maintaining a stable and thus sensitive emulsion phase is a ongoing struggle in the explosives industry, particularly when the emulsion phase is subjected to shear stress during transfer or loading operations (such as when pumping the fluid emulsion blasting agent from one container to another or into a borehole) or when additional ingredients are added and mixed into the emulsion phase (such as energizing aluminum particles or sensitizing glass microballoons). These dynamic operations can cause or accelerate the breakdown of the emulsion phase.

8. The method claimed in the claims of the application provides a way in which an energy-reducing agent (water or aqueous solution) can be added and dynamically mixed into the emulsion phase to reduce significantly the energy of the emulsion blasting agent without destabilizing and desensitizing it.

9. Independent claim 10 contains a method "of reducing the energy of an emulsion blasting agent as it is being loaded into a borehole" comprising the steps of selecting an emulsion blasting agent as specified, conveying the emulsion blasting agent, adding an energy-reducing agent (water or aqueous solution) to the emulsion blasting agent as it is being conveyed, mixing the energy-reducing agent uniformly and homogeneously into the emulsion blasting agent in the claimed amount "to form a second discontinuous phase," adding gassing agents and loading the conveyed emulsion blasting agent into a borehole. By adding the energy-reducing agent as a second discontinuous phase, the emulsion blasting agent is found to retain its sensitivity and stability, which would not be the case if the significant amounts of water or aqueous solution as taught in the specification were combined initially with the inorganic oxidizer salt solution or if the water or aqueous solution were added in a manner that did not form a second discontinuous phase.

10. Dependent claim 15 specifies that the borehole is a perimeter borehole, which as explained in the specification on pages 2-4, makes the invention particularly advantageous since perimeter boreholes can be loaded with a less energetic emulsion blasting agent, while the internal boreholes in the pattern can receive a more energetic load, both from the same base emulsion blasting agent formulation. This versatility is highly desirable.

11. Dependent claim 16 further allows for energy and density variation throughout the length of a given borehole, also advantageous as explained in the full paragraph on page 4 of the specification.

12. In essence, the claimed invention provides a way to reduce significantly the energy of an emulsion blasting agent without desensitizing or destabilizing it. Simply adding from about 5% to about 22.5% by weight of additional water or aqueous solution to an emulsion blasting agent, without forming a second discontinuous phase, would be detrimental if not fatal to the performance of the explosive.

13. The limitations in independent claim 10 distinguishes it from the prior art. The claim requires that the energy-reducing agent, either water or an aqueous solution, be mixed

uniformly and homogeneously into the emulsion blasting agent "to form a second discontinuous phase." This is not just "watering down" an explosive, rather, it is an inventive way of adding water to an explosive to reduce its energy without desensitizing or destabilizing it. This is not disclosed, suggested or implied in any of the references cited by the Examiner.

14. Lawrence et al., Engsbraten and Waldock all disclose adding "dry" ingredients to an emulsion phase. See Lawrence et al., col. 2, lines 55-59; Engsbraten, col. 2, lines 46-49; and Waldock, col. 3, lines 57-62. Although Lawrence et al. disclose that the proportion of ingredients being blended to form a slurry blasting agent (which has a continuous aqueous phase) can be varied as the composition is being delivered into the borehole (col. 1, lines 42-54), they disclose in col. 2 adding only dry ingredients to an emulsion blasting agent. Engsbraten discloses the use of porous, non-aqueous, bulk fillers (solids) as his energy-reducing agent. Once combined with an emulsion phase, the mixture becomes non-pumpable. Further, the emulsion phase in Engsbraten is used in an amount only sufficient for improving adherence between the particulate oxidizer salt and the particulate filler. Waldock similarly uses an inert bulking agent to vary the energy in his composition. This inert, solid bulking agent behaves as an energy

diluent, decreasing the "shock" energy by absorbing heat and not providing additional work energy during detonation.

15. In contrast, claim 10 requires the addition of an energy-reducing agent in the form of water or aqueous solution. Step d) of claim 10 further requires that the liquid energy-reducing agent form a second discontinuous phase in the water-in-oil emulsion phase. The cited references do not disclose the addition of a liquid, water-based energy-reducing agent in the claimed amount to an already formed emulsion blasting agent and that such energy-reducing agent be mixed uniformly and homogeneously into the emulsion blasting agent "to form a second discontinuous phase." These distinctions and order of addition of the energy-reducing agent are significant.

16. As explained in the specification on page 5, lines 7 et seq.:

> The present invention differs from this prior art in that the water or aqueous solution added to the emulsion blasting agent in the present invention is added to the emulsion blasting agent in an amount sufficient to reduce significantly its energy and is mixed uniformly and homogeneously throughout the emulsion phase. In fact, when mixed in this manner the water or aqueous solution forms a second discontinuous droplet phase to that formed by the initial oxidizer salt solution component. This second discontinuous phase renders the emulsion blasting agent more sensitive and stable than if the water or aqueous solution were combined initially

with the inorganic oxidizer salt solution or if they were not mixed uniformly and homogeneously throughout the emulsion phase. (Emphasis supplied.)

17. Even though the final composition contains a considerable amount of water, it remains stable and detonable over time because the additional water is in the form of a second discontinuous phase. If that amount of water simply were added to the aqueous salt solution used to form the emulsion phase, the same detonability would not be achieved.

18. By mixing this high amount of water or aqueous solution uniformly and homogeneously into the emulsion blasting agent to form a second discontinuous phase, the emulsion remains reliably detonable. For example, mix 4, described on page 12 of the specification, and in Tables 1 and 2 on page 13, sat for one hour before being detonated but remained reliably detonable even when its volume energy was reduced by about 55% and as much as 20% by weight water was added and mixed uniformly and homogeneously into the composition.

19. The order of addition of the water or aqueous solution energy-reducing agent is important. The energy-reducing agent must be added to an already formed emulsion blasting agent in order for

the energy-reducing agent to form a second discontinuous phase within the emulsion phase of the emulsion blasting agent.

20. Another advantage of the claimed invention is that the energy-reducing agent reduces significantly the shock to bubble energy ratio of the emulsion blasting agent. As explained on page 12 of the specification:

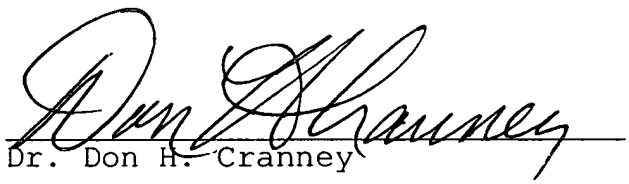
> The shock to bubble energy ratio changed from about 56/44 with standard emulsion blasting agent (mix 1) to about 40/60 for gassed emulsion blasting agent with 20% energy-reducing agent (mix 4). This shift in energy from shock to bubble is highly desirable in blasting operations where wall and perimeter control is required.

The Lawrence et al., Engsbraten, and Waldock references, which all add solid ingredients, do not teach or disclose this beneficial effect of decreasing the shock to bubble energy ratio.

21. Although Patterson et al. disclose an emulsion composition having a second discontinuous phase, the second discontinuous phase is added as an emulsion, not water or aqueous solution, and thus the resulting composition is a blend of two emulsions. Moreover, the second emulsion phase is added principally to increase stability of the composition, particularly when AN prills are used. (See col. 4, lines 9-19.) Finally, the

second emulsion phase is not added as the emulsion blasting agent is being loaded into a borehole, as required in claim 10.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and furthermore that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.



Dr. Don H. Cranney

(x) Related Proceedings Appendix

None.